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(54) The use of a multilayer sheet for producing a multilayer container.

(57) The present invention relates to the use of a multilayer sheet for producing a multilayer container suitable for heat sterilization packaging, which makes the setting of the heat sealing condition at heat sealing of a lid member easy, and is able to make a package which not only has an excellent sealing property, but also a good easy openability and which can be opened with a stable opening force, provides a peeled surface having a good appearance and has an excelent resistance to boiling and retort treatment.

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The use of a multilayer sheet f r producing a multilay r container

The present invention relates to the use of a multilayer sheet for the production of an optionally notched multilayer container. More precisely, the present invention relates to the use of such multilayer sheet for producing a multilayer container suitable for heat sterilization packaging, which makes the setting of the heat sealing condition at heat sealing of a lid member easy, and is able to make a package which not only has an excellent sealing property, but also a good easy openability and which can be opened with a stable opening force, provides a peeled surface having a good appearance and has an excellent resistance to boiling and retort treatment.

Until now, flanged containers have been largely used for packaging foodstuffs or the like, and the container is sealed by heat sealing a lid member thereto after a content is filled therein. The heat seal container thus formed is, however, defective in that, if the sealing property is improved by increasing the heat seal strength, the openability at the time when the content is used is aggravated, resulting in the necessity for an opening operation using an edged tool or the like. On the other hand, if a material having a proper interlaminar strength is selected to improve the openability, since the sealing property varies broadly depending on the heat seal conditions such as temperature, pressure, and time, or owing to matters such as the content sandwiched between the heat seal surfaces, a uniform interlaminar strength cannot be obtained, resulting in a decreased sealing property. Therefore it cannot be used for a package in which the internal pressure is increased by heat sterilization such as boiling and retort treatment.

However, the traditional notion for easy openability was limited to the openability in the peeling opening from the sealing area where a lid member and the flange portion of a container were heat sealed. Therefore, it has been proposed to decrease the heat seal property of the heat sealing layers. However, in this method, a good heat sealing property and an easy openability are incompatible, and the appearance of the peeled surface is deteriorated (e.g. nap or thread), resulting in a decreased commercial value. Therefore, it cannot bring a substantial solution.

It is therefore the task of the present invention to provide a multilayer container which can be advantageously used for a packaging container heat sealed with a lid member which is to be opened by taking advantage of the delamination of the multilayer container instead of by using the heat sealed area of the multilayer container and the lid member as a peeling area; can be easily opened with a stable opening force; has an excellent sealing property since it can be tightly sealed with a lid member, leaving the peelability out of consideration; and, further, has a resistance to boiling or retort treatment.

The subject matter of the present invention is the use of a multilayer sheet comprising at least a peelable surface layer and a layer contacting the peelable surface layer, the interlaminar peeling strength between said two layers being adjusted to a value in the range of 0.2 to 1.5 kg/15 mm, for the production of an optionally notched multilayer container.

The invention further provides a multilayer container obtained by using the above multilayer sheet for producing an easily openable packaging container wherein the inter laminar peeling strength is adjusted to a value in the range of 0.2 to 1.5 kg/15 mm.

Such a multilayer container can be produced dimensionally accurately by a method for producing a flanged container comprising heating a multilayer sheet composed of thermoplastic resins and thermoforming. The thus produced multilayer container of the present invention is to be provided with a notch for cutting its inner layer at the time of opening an easily-openable packaging container produced by the use of the multilayer container and a lid member.

The shape of the multilayer container of the present invention is not critical, and it is usually circular, square, and so forth, and the multilayer container is heat-sealed circularly along a flange portion of the shape. Also, the multilayer container may be cup-shaped or tray-shaped. Further, the flange portion of the multilayer container may be curled or be provided with a rib at the periphery thereof.

Referring to the multilayer structure of the multilayer sheet or the multilayer container, it is not critical as long as the interlaminar peeling strength of the multilayer container is smaller than the heat seal strength of a lid member and the multilayer container, so that delamination occurs between the layers of the multilayer sheet or the multilayer container at peeling of the lid member, and the lid member can be easily opened. The preferable interlaminar peeling strength of the multilayer sheet or the multilayer container is from 200 to 1500 g/15 mm, more preferably from 300 to 1200 g/15 mm (tensile speed : 300 mm/min.). Further, the thickness of the inner surface layer at the flange portion is usually from 5 to 150 μm, preferably from 10 to 100 μm.

Such a multilayer sheet or a multilayer container is not critical as long as it has a multilayer structure composed of such combination of resins or resins and other materials that a proper interlaminar peeling

strength is obtained. Examples of suitable resins are polyolefin base resins, polystyrene base resins, polyamide base resins, polyester base resins, polycarbonate base resins, and the like, a mixture thereof, or a mixture thereof in which from 5 to 70 % by w ight of various lastomers and various additives or inorganic fillers are further mixed thereto.

Examples of resin combinations of layers are a combination of (a) a polypropylene or a polypropylene mixed with not more than 20 % by weight of a polyethylene or an elastomer, and (b) a polyethylene or a polyethylene mixed with not mre than 40 % by weight of a polyethylene, a combination of a polystyrene and an ethylene-vinyl acetate copolymer, and a combination of an inorganic filler containing polyolefin and a polyethyleneterephthalate.

Subsequently, as a preferable example which can be used for boiling or retort treatment, a multilayer structure composed of a combination of (A) a resin mixture layer of polypropylene base resin-polyethylene base resin and (B) a high density polyethylene resin layer may be suitably used. Examples of the polypropylene base resin to be used for the resin mixture layer are a random copolymer of propylene and an α-olefin such as ethylene, butene-1, pentene-1, 3-methylbutene-1, and 4-methylpentene-1, and a mixture thereof, in addition to a high crystalline propylene homopolymer. Herein, the random copolymer may also be a mixture thereof with a homopolypropylene obtained by multi-stage polymerization. Amongst the above-mentioned copolymers, those preferred have a ratio of the copolymerizing monomer of not more than 10 mole %. Further, in these polypropylene base resins, those having a melt index (MI) ranging from 0.1 to 20, preferably from 0.2 to 15, are suitable.

On the other hand, either a low density polyethylene (a high pressure process low density polyethelene, a linear low density polyethylene, etc.), a medium density polyetheylene, or a high density polyethylene may be used as the polyethylene base resins for the said resin mixture layer. Also, in addition to an ethylene homopolymer, a crystalline, low crystalline, or amorphous random or block copolymer of ethylene with an α-olefin, such as propylene, butene-1, pentene-1, 3-methylbutene-1, and 4-methylpentene-1, or an unsaturated carboxylic acid such as vinyl acetate and acrylic acid, or a mixture thereof may be used. In the above-mentioned copolymers, those preferred have a ratio of the copolymerizing monomer of not more than 20 mole %. Further, in these polyethylene base resins, those having both of a melt index ranging from 0.02 to 50, preferably from 0.05 to 30, and a density ranging from 0.850 to 0.980 g/cm^3, preferably from 0.900 to 0.975 g/cm^3, are suitable.

The ratio between the above-mentioned polypropylene base resin and polyethylene base resin is preferably selected among a range from 50:50 to 97:3, more preferably from 60:40 to 95:5, by weight.

Further, if desired, the resin mixture may be blended with the third resin component in order to improve the compatibility or to control the adhesive property. Examples of the third resin component are, a modified polyolefin modified with an unsaturated carboxylic acid or a derivative thereof, an ethylene-vinyl acetate copolymer, an ethylene-acrylate copolymer, an ethylene-propylene rubber, an ethylene-propylene-diene rubber, a polybutene, a polyisobutylene, a polybutadiene rubber, a polyisoprene rubber, an atactic poly-4-methylpentene-1, a styrene-butadiene rubber, an acrylonitrile-butadiene rubber, and an ioncrosslinked olefin copolymer (ionomer), and these may be used either individually or in combination of two or more of them. Preferably, these third components are used in a quantity of not more than 30 parts by weight per 100 parts by weight of the polypropylene base resin.

Examples of the high density polyethylene resin to be suitably used for the other layer of the multilayer container, i.e. the high density polyethylene resin layer, are, in addition to an ethylene homopolymer, copolymers of ethylene and an α-olefin such as propylene, butene-1, pentene-1, 3-methylbutene-1, and 4-methylpentene-1, and the like. In these copolymers, those preferred have a ratio of the copolymerizing monomer of not more than 10 mole-%. In the high density polyethylene resins, those having a melt index ranging from 0.01 to 50, preferably from 0.02 to 20, and a density ranging from 0.940 to 0.975 g/cm^3 are preferable, and they may be a mixture of those having different densities or molecular weights.

Although the multilayer container produced may be of a two-layer type composed of the above-mentioned resin layers, with the object of increasing the gas barrier property or decreasing the deformation of the container, it may be a multilayer type composed of three or more layers using layers of other materials. Examples of the materials of other layers are, a resin layer such as an ethylenevinyl alcohol copolymer, a polyvinylidenechloride, nylon, and a polyethyleneeterephthalate, or a deposited metal layer (e.g. deposited aluminium layer), which has a good gas barrier property. The layer composed of these oth r materials may be either one layer or a laminate composed of two or more layers, and may also be provided with a resin layer containing from 10 to 80 % by weight of an inorganic filler. In the case of these multilay r structur s, depending on the combination of the resins, lamination may be carried out be using an adhesive resin such as a polyolefin modified with the above-mentioned unsaturated carboxylic acid or th derivates thereof, an ionomer, and the like.

The thicknesses of the said resin mixture layer and high density polyethylene resin layer are usually in the range from 10 to 1000 µm, preferably from 2 to 500 µm. The inner surface layer can be made thin since the outer layers will maintain the strength of the multilayer container and the inner surface layer has only to protect the content and be heat sealed with a lid member.

The multilayer structure of the multilayer container is to be properly selected depending on the sealant layer of the lid member, and, for example, when the sealant layer of the lid member is a polyethylene base sealant layer, in the case of the above-mentioned combination of resin layers, a high density polyethylene layer is to be used as the inner surface layer of the multilayer container. Herein, the multilayer container of the present invention may also have another layer such as a seal layer on the inner side of the inner surface layer of the multilayer container if necessary, as long as it has the feature of the present invention that the multilayer container has a peeling layer.

When a metal layer such as iron (tin plate, galvanized sheet iron) and copper is used as the outer layer of the present invention, a resin layer having an easy peelability from the metal layer, for example, a polyolefin such as a polyethylene, a polypropylene, an ethylene-α-olefin copolymer, and an ethylene-vinyl acetate copolymer; a mixture of the said polyolefin and a modified polyolefin obtained by graftmodifying the above-mentioned polyolefin with an unsaturated carboxylic acid such as maleic anhydride or a derivative thereof; an ionomer; and a polyethyleneterephthalate, is used for the inner surface layer. By using this multilayer container, an easily-openable packaging container which is tolerable to boiling and retort treatment and having an excellent strength, rigidity, pressure resistance, and heat stability, can be produced. Further, the outer layer may be of paper, resin impregnated paper, or the like.

The invention may be described in more detail with reference to the drawings.

Fig. 1 is a sectional view showing a structure of a notched multilayer container obtainable by forming a notch into a multilayer container according to the present invention.

Fig. 2 is a sectional view of a container in which the multilayer container shown in Fig. 1 is heat sealed with a lid member.

Fig. 3 is a sectional view of a notched multilayer container obtainable by forming a notch into a multilayer container of another embodiment of the present invention.

Fig. 4a, Fig. 4b, Fig. 4c, Fig. 4d and Fig. 4e are each an explanatory view showing the method for forming a notch.

Fig. 5 is a process view showing a process for producing a multilayer container of an embodiment according to the present invention.

Fig. 6 and Fig. 7 are each a schematic sectional view of an apparatus for forming a notch into the multilayer container of the present invention.

Fig. 8 is a partially sectional view of an easily openable packaging container obtainable by using a multilayer container of an embodiment according to the present invention.

Fig. 9 is a partially sectional view of another easily-openable packaging container obtainable by using a multilayer container of another embodiment according to the present invention.

Fig. 10 to 12 are partially sectional views of other easily-openable packaging containers obtainable by using multilayer containers of other embodiments according to the present invention.

Fig. 13a is a partially sectional view of another easily-openable packaging container obtainable by using a multilayer container of another embodiment according to the present invention and Fig. 13b is a partially sectional view illustrating a state wherein the lid member of the easily-openable packaging container shown in Fig. 13a is being peeled.

Fig. 14a and 14b are explanatory sectional views illustrating an example of operation for forming a notch on a multilayer container of the present invention.

Fig. 15 and 16 are each a perspective view of a notched multilayer container obtainable by forming a notch to a multilayer container of another embodiment according to the present invention, and

Fig. 17 and Fig. 18 are partially sectional views of easily-openable packaging containers wherein the notched multilayer containers shown in fig. 15 and 16 are heat sealed with lid member.

Fig. 19 is a partially sectional view of another easily-openable packaging container obtainable by using a multilayer container of another embodiment according to the present invention, and

Fig. 20 is a partially sectional view illustrating a state wherein the easily-openable packaging container shown in Fig. 19 is being opened.

Fig. 21 is a sectional view of an example of a lid member to be used for a container of the present invention.

Fig. 22 is an explanatory view illustrating an apparatus for filling an article in the multilayer container of the present invention and further sealing the container with a lid member to produce a packaging container.

Fig. 23 is a partially sectional view of more other easily-openable packaging container obtainable by using a multilayer container of more other embodiment according to the present invention.

Fig. 24 is a sectional view of a test piece for measuring th peeling strength of a packaging container.

The invention will now be xplained in more detail with reference to the figures.

Fig. 1 is a sectional view showing the structure of a notched multilayer container obtainable by forming a notch to a multilayer container of the present invention. Reference numeral 1 represents an inner surface layer of the multilayer container, reference numeral 2 represents a layer contacting thereto, and reference numeral 3 represents a notch formed at the inner pheripheral portion of a flange portion. Reference numeral 4 represents a flange portion which is to be used for heat-sealing the inner surface layer 1 of the multilayer container and a lid member after an article is filled and a lid member is covered.

At the peripheral portion of the flange portion of the multilayer container, notch 3, capable of cutting the inner surface layer at peeling of the inner surface layer on the flange, is formed. Any kind of notch will be available to this notch, as long as they can cut the inner surface layer at peeling of the lid member, and therefore, the notch may also extend into the layer contacting the inner surface layer so as to extend only to the middle of the inner surface layer. Further, the shape of the notch is not critical, and, for example, it may be U-shape, V-shape, cut line (half cut), etc. Also, it may be cut in from the underside of the inner surface layer. Further, the notch may be formed completely circularly at the entire inner peripheral portion of the flange portion, but a part of the inner peripheral portion may also remain unnotched. In the case of partially peeling the lid member, only the part which is not peeled is to be unnotched.

Referring to Fig. 2, which is a sectional view illustrating a state where the multilayer container is covered with a lid member 5 and heat-sealed, reference numeral 6 represents a heat seal portion, and the multilayer container and the lid member are peeling-resistively heat sealed at the flange portion of the multilayer container. The peeling strength of the seal portion sealing the inner layer of the multilayer container with the lid member is larger than the interlaminar peeling strength of the inner layer of the multilayer container, and the preferable peeling strength is usually not less than 2.0 kg/15 mm, more preferably not less than 2.5 kg/15 mm (tensile speed: 300 mm/min). Reference numeral 7 represents a picking portion for making the peeling easy. As the sealing method, conventional methods for heat sealing plastic films such as heat seal method, impulse seal method, high-frequency bonding method, and ultrasonic wave bonding method may be used.

Although the lid member 5 is a one-layer film in the multilayer container shown in Fig. 2, it may be a one-layer film or a multilayer film depending on the specific embodiment. When the lid member is formed of a multilayer film the multilayer films to be suitably used are those composed of a substrate and a sealant layer, wherein the substrate is made of a one-layer film of a plastic, a multilayer film of plastics, a paper, an aluminium foil, a complex layer thereof, or the like, and the sealant layer is composed of a resin having an easy-heat-sealing property at the inner surface layer of the multilayer container such as those made of a polyethylene, a polypropylene, an ethylene-α-olefine copolymer, or an ethylene-vinyl acetate copolymer.

Referring to Fig. 3 which is a sectional view showing another multilayer container obtainable by forming a notch to a multilayer container of the present invention, a rib 8 is formed at the outer periphery of the flange portion. A curl may also be formed instead of the rib. In these cases, although the peeling of the lid member might be difficult, a second notch formed at the outer periphery of the flange portion will facilitate the peeling.

The multilayer sheet of the present invention can be produced from the resins of the above-mentioned combinations by co-extrusion process or laminating process. For the laminating process, for example, extrusion lamination, hotmelt lamination, dry lamination, wet lamination, and the like may be employed.

The multilayer container can be produced from the resins of the above-mentioned combination by the method of thermo-forming, such as vacuum forming and pressure forming, of a co-extrusion multilayer sheet or a laminate sheet, multilayer injection molding, multilayer injection blow molding, multilayer blow molding, or the like. Further, it may also be produced by draw forming a multilayer sheet composed of a metal, such as aluminium, and a resin or thermoforming a multilayer film on the inside of a paper container.

The multilayer container obtainable from the multilayer sheet according to this invention may be used for producing a notched packaging container, as will be described later.

The notch that is to be formed in the inner surface layer of thus obtained multilayer contain r of the present invention is a means for causing cutting of the inner surface lay r at th inner peripheral portion of the flange portion at delamination of the inner surface layer of the flange portion, and it can be formed by pressing with a notching blade, pressing with a heating blade, cutting with a cutting edge, a heating means, or a combination thereof.

The pr ferable means for forming a notch is pressing with a heating blade or the like, and examples of

the heating means, which is not critical, are electric-heater means, heating with a heating medium, impulse heating, high frequency heating, ultransonic wave heating, and the like. These means are combined with a U-shaped or V-shaped ring pressing member to form a notch. When pressur and heat are employed jointly, it is preferable that the inner surface layer of the multilayer container is made of a resin having a melting point or a softening point lower than those of the outer layer and, at the same time, the thickness of the inner surface layer is not more than 200 μm.

In particular, by using a heat infusible material such as a metal for the outer layer, the notch can definitely be formed only in the inner layer.

Referring to Figs. 4a, 4b, 4c, 4d and 4e illustrating the method for forming a notch, Fig. 4a shows the state where a notch is being formed by pressing a notching blade, Fig. 4b shows the state where a notch is being formed by recessing with a cutting blade, Fig. 4c shows the state where a notch is being formed by projecting a multilayer sheet from the underside and then cutting the pojecting part, Fig. 4d shows the state where a notch is being formed by pressing a heating ring, and Fig. 4e shows the state where a notch is being formed by ultrasonic wave heating.

The method for producing the multilayer container with a notch of the present invention will be explained with reference to the attached drawings. Fig. 5 illustrates an example of the process for producing a multilayer container by the method of the present invention.

In Fig. 5 reference numeral 31 represents a multilayer sheet composed of thermoplastic resins, and the multilayer sheet is thermoformed into a flanged multilayer container by feeding it to a heating step 32 to heat to a temperature at which the sheet can be transformed, then feeding it to a thermoforming step 33.

Fig. 6 and Fig. 7 are sectional rough explanatory drawings of apparatuses for forming a ring notch in the inner surface of the multilayer container of the present invention; Fig. 6 shows an apparatus wherein a ring blade is situated in the upper part and a container guide is not installed inside the ring blade, and Fig. 7 shows an apparatus wherein a ring blade is situated in the lower part and a container guide is installed inside the ring blade.

In those drawings, a ring blade 43 is a means for forming a ring notch on the upper surface of the flange portion of a multilayer container and is equipped with a heater 45 as heating means. The ring blade has a controllable blade length.

As shown in Fig. 6, although a sufficient accuracy can be obtained in notch forming without guide inside a ring blade, as shown in Fig. 7, it is preferable to install a container guide 46 inside the ring blade 43 in order to increase the forming accuracy furthermore. Though the shape of the ring blade 43 varies depending on the shape of the flange portion of the multilayer container, usually, it has a continuous ring shape such as circular shape, triangular shape, square shape, and oval shape, and as the material thereof, for example, high carbon steel (Tomson blade), chrome-stainless steel, aluminium ceramics, or the like may be employed.

On the other hand, a supporting member 47 serves for supporting a flange portion at forming of a notch and has a container receiving portion 44. The supporting member 47 and the above-mentioned ring blade 43, at least one of them is capable of ascent and descent, are each secured to an apparatus proper 41 and 41′ through an elastic member 42 and 42′. As the elastic member 42, 42′, for example, a spring or a dashpot may be used. By the use of the elastic member, a uniformity of pressing pressure and an increase of the accuracy of the notch forming depth can be obtained. Also, when a container guide 46 is provided inside the ring blade 43, it is preferable to secure the container guide to a ring blade mounting member through the elastic member 42.

In order to form a notch at the flange portion of the multilayer container by using this apparatus, at first, the multilayer container is placed into the container receiving portion or mounted onto the container guide 46, then, in the former case, by elevating the supporting member 47 or lowering the ring blade 43, or by both of them, a notch is formed at the flange portion of the container. In the later case, a notch is formed at the flange portion of the container by elevating the ring blade 43 or lowering the supporting member 47, or by both of them. At this time, the temperature of the ring blade 43 is properly controlled depending on the kind of resin, the time of forming of a notch, the depth of the notch to be formed, and the like.

By means of the multilayer container of the present invention there may be provided an easily-openable packaging container having a high seal strength and a good, easy openability, wherein the said multilayer container is filled with an article and heat sealed with a lid m mber.

Fig. 8 is a partially sectional view of such an easily-openable packaging container wherein the above-mentioned multilay r container and lid member are employed.

Reference letter A represents a multilayer sheet usually formed of a co-extrusion sheet or the like which is formed into a multilayer container 10 by vacuum forming or pressure forming. The multilayer container is provided with a flange portion 4 for heat sealing a lid member.

The multilayer structure A of the multilayer container is composed for an inner surface lay r 1 which can be peeling-resistiv ly heat sealed to a sealant 12 of the lid member and an outer layer 2 whose adhesive strength to the inn r surface layer is smaller than that of the peeling-resistive heat seal.

The inner surface lay r of the multilayer container and the lid member are heat sealed at a heat seal portion 6 in the flange portion of the container.

At the opening portion side of the inner surface layer of the multilayer container on the flange portion, a ring notch 3 is cut in.

Fig. 9 is a partially sectional view of another embodiment of an easily-openable packaging container. In this case, the periphery of the flange portion of the container is curled inwardly. In this case, a notch 14 shown in the figure formed into the inner surface layer at the peripheral side of the flange portion of the container permits the inner surface layer to be peeled easily.

The periphery of the lid member is projected to the outer side of the multilayer container to form a picking portion 7, to serve the convenience of picking at opening.

The easily-openable packaging container in which the multilayer container of the present invention is filled with an article and heat sealed with a lid member can be easily opened by the following simple motion.

For example, referring to Fig. 8, the picking portion 7 is lifted upward. Thereupon, delamination of the multilayer container occurs between the inner surface layer 1 and the layer 2 contacting thereto, and the inner surface layer is peeled as far as notch 3, causing the lid member to be peeled. Therefore, the opening can be easily performed even if the lid member and the multilayer container are peeling-resistively heat sealed.

Also, in contrast to the conventional method in which the peeling occurs at a seal area, a stable opening strength can be obtained because of the absence of notch effect caused by an imperfect seal at the seal end, difference in sealing condition, influence of foreign matters, and the like. Further, since peeling can be performed easily even if the peeling strength of heat seal is increased, the easily-openable packaging container will be of such a good heat-resistance as to resist boiling and retort treatment.

Referring to Fig. 9, by lifting the picking portion, the inner surface layer and the outer layer is delaminated from a notch on the outer peripheral portion, and thereafter the lid member can be easily opened as mentioned above.

In the easily-openable packaging container it is preferable to leave a space between the inner end of the heat seal portion and the notch. The length of the space t is from 0.5 to 10 mm, preferably 1.5 to 5 mm. The space proves a packaging container having a peeling strength for peeling from the inside of a container larger than that of peeling from the outside, so that a packaging container can be obtained which is excellent in packaging of foodstuffs where a heat resistance and pressure resistance is required against boiling, retort treatment, and the like. Although the reason is not apparent, it is supposed that, in the case of peeling from inside, the stress concentrates to point X and the shearing strength of the Y-Z area becomes the peeling strength of that from the point Y so that the peeling strength is increased. If the length of t is less than 0.5 mm, the peeling strength of from inside of the container is not sufficiently larger than that of from outside, and a length of more than 10 mm is not practical.

When a space t is provided as mentioned above, an accurate control of the heat seal position on a plane flange portion becomes difficult. Thus, in the case of the easily-openable packaging container, it is preferable to provide a ring notch at a non-heat seal surface more on the inside than the heat seal portion.

Fig. 10 is a partially sectional view of an easily-openable packaging container obtainable by the use of the multilayer container of the present invention. In this case, the flange portion 4 of the multilayer container is not completely plane, the inner peripheral portion of the flange portion declines gradually toward the inner side of the multilayer container, and a notch 3 is provided on the declined surface. That is to say, the notch is provided on a non-heat seal surface 15, i.e. the inclined surface of the flange portion. Now, if the space between the point where the non-heat seal surface of the flange portion begins and the notch is represented by t', heat sealing by the use of such multilayer container prevents heat sealing in the space (length t') from the outer end of the non-heat seal surface to the notch, and controls the length of t to at least the length of t', even if the heat seal portion deviates, so that a sufficient pressure resistive sealing property and an easy openability can be exhibited.

Fig. 11 is a partially sectional view of an easily-openable packaging container of another embodiment. In this embodim nt, in order to provide a notch at a non-h at seal portion, a difference in l vel is provided in the inner peripheral portion of a flange portion 4, and a notch 3 is provided at a dropped surface 16 of non-heat seal surface.

Fig. 12 is a partially sectional view of an easily openable packaging container of an embodiment in which a rib 17 for nforcement is formed at the outer peripheral portion of a flange portion 4. This container

is provided with a notch 14 in the inner surface layer 1 at the outer peripheral portion of the flange portion.

In addition to such a declined surface as shown in Fig. 10 or a dropped surface as shown in Fig. 11, any non-heat seal surface will be employed, as long as it consists of an area unable to contact a lid member at heat sealing, such as a curved surface and the like. Since a notch is provided at a non-heat seal surface, by using a relatively wide heat seal ring at the time when a lid member and a multilayer container is heat sealed, the entire flat surface portion of the flange portion can be sealed even if the seal shifts, so that both a uniform length of t and a uniform position of the outer end of the heat seal portion can be obtained. Therefore, the heat seal operation can be easily conducted, and a stable opening strength can be obtained.

Further, in the easily-openable packaging container, it is preferable to make a heat unfusible layer on at least one of the flange portions inside the heat seal portion and the lid member, and to provide a ring notch inside the heat seal portion.

Fig. 13 is a partially sectional view of an easily-openable packaging container of another embodiment. In this case, a heat unfusible layer 18 is formed inside a heat seal portion 6 of a flange portion 4 of a multilayer container, and this portion will not be sealed when a lid member is heat sealed to the flange portion with a heat seal ring. Therefore, a fixed space can be provided between the inner end of the flange portion and the notch. Although the heat infusible layer is provided at the flange portion in Fig. 13a, the heat infusible layer may also be provided on a lid member. The material of the heat infusible layer is not critical as long as it can prevent the heat fusion of a flange portion and a lid member at the time when the flange portion and the lid member is heat sealed. A notch 3 is provided at the heat infusible portion of the inner surface layer in the flange portion previously. Heat sealing by using such a container makes it possible to control the length of t to be fixed, and this a sufficient sealing property and an excellent easy openability can be exhibited.

Fig. 13b is a partially sectional view illustrating a state where the lid member shown in Fig. 13a is being peeled. Following the occurrence of a delamination of a multilayer container, the inner surface layer is cut at the notch, resulting in the peeling at the lid member.

Fig. 14a and Fig. 14b are sectionally explanatory drawings illustrating a method for conducting both of heat sealing of the multilayer container of the present invention with a lid member and forming of a notch simultaneously. A heat seal ring 19 is provided with a sealing member 20 for heat sealing and, at a distance t from the seal portion, a ring member 21 in one body. By conducting heat sealing and forming of a notch simultaneously like this, a fixed t and a good operation efficiency can be obtained and, further, heat sealing and forming of notch can be performed without damaging the shape of the container. In this example, however, it is required that the condition of the length of the ring member or the like is so predetermined as to cause no damage of the lid member at forming of a notch. Further, in order to keep the shape of the multilayer container from damage, it is perferable to employ an unfusible material, such as a resin having a melting point higher than that of the material of the inner surface layer 1, a metal, or the like, as the material of the layer 2 contacting to the inner surface layer. Such a heat unfusible layer provided thereto permits a notch to be formed at the same time or after heat sealing, and, therefore, the conventional packaging process may be employed.

Further, when a rib or a curl is provided to the multilayer container of the present invention in order to improve the strength of the flange portion of the multilayer container, the handling feeling, and the design quality, it is preferable to provide a cut-off portion in the vicinity of the flange portion of the rib portion of the curl portion.

Fig. 15 is a perspective view of an easily-openable packaging container of an embodiment in which a cut-off portion 22 is provided at a rib portion 8. In this case, the cut-off portion 22 extending from the underside to the flange level is provided in the rib portion which is provided on the end of the flange portion of a multilayer container. The inner end portion of the flange portion 4 is formed into a non-heat seal surface 15 of a gradually inclined plane, and notch 3 is provided on the non-heat seal surface 15.

Fig. 16 is a perspective view of a multilayer container to be used for an easily-openable packaging container of another embodiment. In this case, a cut-off portion of a rib portion 8 is not cut at a poisition where it contacts a flange portion 4, but rises to the flange level to form a flat surface 23. Also, in this case, either side of the flat surface 23 may be connected to the rib 8.

Fig. 17 is a partially sectional view of a cut-off portion of an easily-openable packaging container in which the multilayer container shown in Fig. 15 is heat sealed with a lid member. A notch 3 is provided to a non-heat seal surface 15 of a flange portion 4. A heat seal portion 6 extends to the outer periphery of the flange portion 4. A lid member (12,13) is provided with a picking portion 7 for making opening easy. Fig. 18 is a partially sectional view of a part including a cut-off portion of an easily-openable packaging container in which a lid member is heat sealed to the multilayer container shown in Fig. 16.

As mentioned above, in comparison with the conventional methods in which opening is performed by peeling a lid member and a multilay r container from a sealing area, since the easily-openable packaging container obtained from the multilay r container of the present invention is opened by delaminating the multilayer container, it can be opened easily even if the lid member and the multilayer container is peeling-resistively heat sealed. Because of the above-mentioned possibility of strong sealing, the range for selecting the material and shape of the lid member is so wide that, for example, a drop lid as shown in Fig. 21 also may be used. Packaging using a drop line has the advantage that the residual air in the container can be reduced, causing an increase in the keeping quality of foodstuffs. However, opening of containers made by conventional packaging methods has been difficult because, when a content such as soup is filled into the container, the overflowing of the content by setting of a drop lid causes such bad effects to the seal portion at heat sealing that a strong sealing is required. However, since the packaging containers of the present invention can be sealed strongly, a drop lid can be suitably used for them.

When a packaging container is produced using the multilayer container of the present invention, a notch can be provided on an inner surface layer of a flange portion either before or after filling an article. The notch may be formed by, for example a physical method using a notching blade or a cutting blade, a heating method by heat-ray fusing cutting (impulse), or a heat blade, a mechanical vibration method using ultrasonic wave, an internally exothermic method using high frequency, or the like. When such a notch is provided before filling of an article, said article is subsequently filled into the said container, then a lid member is heat-sealed to the flange portion. For example, a notch can be easily formed by pressing a ring notching blade having a V-shaped edge (heated when necessary). In this case, a notch forming ring may be installed to a conventional non-heating hitting ring before sealing. In the case of a container with a tongue piece of peeling, it is preferable to heat-seal the end portion of the tongue piece securely to the lid member. Also, it is desirable to form a penetrating notch in the sheet. When a notch is formed after filling of an article, a lid member is subsequently heat-sealed to the flange portion.

After a lid member is heat-sealed in this manner, the periphery of the heat-seal portion is punched to obtain a package having a peelable opening part. In this case, two or three containers may be punched in one body.

In the above mentioned method for filling and packaging, "forming of a container" means not only forming in a through line but also a multilayer container formed previously.

Fig. 22 is an explanatory drawing showing an example of an apparatus comprising a means for forming multilayer containers, a means for filling an article in the multilayer containers, a means for forming a notch, a means for heatsealing the multilayer containers with a lid member, and a means for punching produced easily-openable packaging containers.

In the container-forming means, the multilayer sheet 51 is formed into containers by, for example, vacuum forming or pressure forming.

The container thus formed is then fed to an article filling means 54 to be filled with an article, and thereafter, in a notch forming means 55, a notch is provided on an inner surface layer of a flange portion inside a heat seal portion of the flange portion and a lid member. In this apparatus, the above mentioned article filling means and the notch forming means may be inverted, and the notch forming means may include a non-heating hitting means. Subsequently, a lid member is heat-sealed to the flange portion of the container in a lid member heat sealing means 56, then the periphery of the heat sealed portion is punched to obtain a package having a peelable opening part. Reference numeral 58 represents a lid member film.

According to the above-described method and apparatus, an easily-openable packaging container can be produced by using a multilayer sheet as a starting material without addition of special processes, and, in a particular case, by a through process comprising the steps from the forming of a container to punching. Therefore, the content is never polluted, and the packaging cost is low.

EXAMPLES

The present invention will be described in more detail by reference to the following examples, but the present invention is not to be limited to these examples.

EXAMPLE 1

A multilayer sheet (I) mentioned below was formed by co-extrusion process.

inner layer : a high density polyethylene 70μm (IDEMITSU POLYETHYLENE 440M produced by Idemitsu Petrochemical Co., Ltd., density: 0.96g/cm³, MI: 0.9g/10min., molecular weight distribution: narrow)

outer layer : a polypropylene base resin layer 200μm: a mixture of 80 % by weight of a polypropylene (IDEMITSU POLYPRO E-100G produced by Idemitsu Petrochemical Co., Ltd. ,MI: 0.6g/10min.) , 15 % by weight of a low density polyethylene (PETOROSEN 172 produced by Toyo Soda Mfg. Co., Ltd., density: 0.92g/cm³, MI: 0.3g/10min.) , and 5 % by weight of a high density polyethylene (IDEMITSU POLYETHYLENE 530B produced by Idemitsu Petrochemical Co., Ltd.)

by using the multilayer sheet (I) , a flanged multilayer container of 60 mm ϕ x 40 mm (height) was formed by pressure thermo-forming. A notch was formed at the inner peripheral portion of the flange portion of this multilayer container by the following three methods.

(1) A notch was formed by pressing a ring notch blade of 0.8 mm in thickness having a sharp edge.

(2) A notch was formed by pressing a seal ring of 1 mm in width at from 170 to 190°C and 2kg f/cm² for one second.

(3) A notch is formed by contacting a ring notching blade to a part to be provided with a notch, and treating with ultrasonic wave from the opposite surface (900W. radiating time: 0.05 - 0.09 sec.).

The inner layers of multilayer containers produced by these methods were peeled, and then all of the inner layers were cut at the notch portion.

When a lid member (1) made of an oriented nylon/polyvinylidenechloride/linear polyetheylene (15μm/20 μm/ 40μm) was heat sealed to the multilayer container at the flange portion and the lid member was peeled, delamination of the multilayer sheet of the multilayer container occurred, then the inner layer of the multilayer container was cut at the notch portion, and opening was performed easily.

EXAMPLE 2

A multilayer sheet (II) (0.8 mm in thickness) consisting of six layers of four kinds was formed by co extrusion forming.

a:b:c:d:c:b = 50:350:20:30:20:350:(μm)

a: a high density polyethylene (IDEMITSU POLYETHYLENE 440M produced by Idemitsu Petrochemical Co., Ltd., density: 0.96g/cm³, MI: 0.9g/10min., molecular weight distribution: narrow)

b: a mixture of 80 % by weight of a polypropylene (IDEMITSU POLYPRO E-100G produced by Idemitsu Petrochemical Co., Ltd., MI: 0.6g/10min.), and 20 % by weight of a low density polyethylene (PETOROSEN 172 produced by Toyo Soda Mfg. Co., Ltd., density: 0.92g/cm³, M I: 0.3g/10min.)

c: a polypropylene modified with maleic anhydride (IDEMITSU POLYTAC E100 produced by Idemitsu Petrochemical Co., Ltd.)

d: a saponificated ethylene-vinyl acetate copolymer (EVAL EP-F101 produced by Kuraray Co., Ltd., ethylene content: 32 mol%, MI: 1.3g/10 min.)

A flanged container of 60 mm ϕ x 40 mm (height) was produced by heating the multilayer sheet (II) to formable temperature, inserting it on a mold as shown in FIG.6, lowering a sheet press ring, forming by pressure thermo-forming, lowering a ring notching blade, elevating a ring notching blade, and lowering a punching blade. A ring notch of 60 μm in depth was formed in the flange portion as shown in FIG. 23.

Thereafter, a lid member (1) (e:f:g) used in Esample 1 was heat sealed to the flange portion under conditions of temperature of 170°C, pressure of 4 kg, 1.5 seconds, and double pressing sealing. using the linear low density polyethylene layer as sealing layer.

Peeling test for the flange portion of the sealed container was conducted in accordance with JIS K 6854. Further, after the container was filled with water and applied to a retort treatment of 120 °C, 30 minutes, peeling test was conducted again. The results are shown in Table Herein, there was no breakage after the retort treatment, and the container had an excellent gass barrier property.

EXAMPLE 3

A container was produced by the same procedure in Example 2 providing the high density polyethylene was altered to IDEMITSU POLYETHLENE 530B (Id mitsu Petrochemical Co., Ltd., MI: 0.3g/10 min., density: 0. 957g/cm³, molecular weight distribution: broad). The results are shown in Table.

TABLE Peeling strength

		Example 2 (g/15mm)	Example 3 (g/15mm)
opening side	before retort treatment	950	700
	after retort treatment	700	550
non-opening side	before retort treatment	3,500	2,900
	after retort treatment	3,100	2,500

EXAMPLE 4

A multilayer container having a flange portion of 50mm φ in opening portion, 40mm φ in bottom face, 20 mm in height, and about 200 μm in thickness was formed from an aluminium sheet coated with a polypropylene modified with maleic anhydride (0.6 mm in thickness, resin layer 150 μm) by stretch forming. At the inner resin layer of the multilayer container in the inner portion of the flange portion, a ring notch extending to the metal layer was formed with a heat blade along the inner periphery of the flange portion. Then, to this container, a lid member which had an aluminium foil layer of 20 μm in thickness and a sealing layer of 50 μm in thickness formed from a polyethylene containing ethylenevinyl acetate copolymer modified with maleic anhydride was heat sealed. The space t between the inner end of the heat seal portion and the notch was adjusted to 1 mm.

When the sealed lid member was peeled, delamination occurred between the metal layer and the easily-peelable resin layer, and opening was performed easily with a uniform peeling force.

EXAMPLE 5

A multilayer container of 60 mm in diameter of opening portion, 50 mm in diameter of bottom face, and 25 mm in height was produced from a multilayer sheet by pressure thermo-forming. The inner layer of the flange portion was a high density polyethylene (50 μm), and the outer lay r was a polypr pylene bl nded with 10 % by weight of an ethylene-propylene rubber (500μm).

At the flange portion of the container, a ring notch extending nearly to the outer layer was formed.

Then, a lid member of a multilayer film (PET/EVOH/LLDPE : 12μm/ 20μm/ 30μm) was heat sealed by using LLDPE as the sealing layer, to obtain an easily-openable packaging container. When the container was peel d from a picking portion, delamination of the multilay r container occurred, and peeling feeled good.

EXAMPLE 6

A multilayer sheet and a lid member having the layer structure shown in FIG. 24 were produced.

On an co-extruded multilayer sheet (III) consisiting of

a: a mixture of 80 parts by weight of a polypropyelene (IDEMITSU POLYPRO E-100G produced by Idemitsu Petrochemical CO., Ltd., density: 0.91g/cm^3, MI: 0.6g/10min.) and 20 parts by weight of a low density polyethylene (PETOROSEN 172 produced by Toyo Soda Mfg. Co., Ltd., density: 0.92g/cm^3, MI: 0.3g/10min.)

b: a high density polyethylene (IDEMITSU POLYETHYLENE 440M, density:0.96g/cm^3, MI: 0.9g/10min.) (layer a: 200 μm in thickness, layer b: 50 μm in thickness), a notch of 70 μm in depth was formed.

To this sheet, the lid member (1) (e:d:c) used in Example 1 was heat sealed under the conditions of temperature of 170°C, pressure of 1.5 kg/cm^2, and 1.5 seconds, using the linear low density polyethylene layer as the sealing layer, altering the space t. 180 ° peeling strength of the seal portion was measured in accordance with JIS K 6854. The result was such that delamination occurred between a and b, and the peeling strength was as follows:

t = 0 mm 0.54 kg/15 mm
1 mm 2.2 kg/15 mm
3 mm 3.5 kg/15 mm
5 mm > 4 kg/15 mm

Next, containers each having t of 2mm and 4mm, above-mentioned layer structure, and shape shown in FIG. 12 were produced. Then, after water was filled, these containers were heat sealed and retort treated at 120 °C for 30 minutes. These containers were not opened at all. Each container had an opening strength of about 0.9 kg/15 mm before retort treatment, and about 0.6 kg/15 mm after retort treatment, and was easily opened. The peeled surfaces were smooth.

Further, an internal pressure was applied with a pump to a sealed container having t of 2mm produced by heat sealing a lid member to a container filled with water, and the internal pressure at which the lid member was peeled was measured. (average value of five containers)

before retort treatment 1.45 kg/cm^2
after retort treatment 1.30 kg/cm^2
(conditions of retort treatment : 120 °C, 30 minutes)

When the internal pressure is applied, after the lid member expanded to a hemispherical shape from the inner end of the sealing area (point X), delamination of the multilayer container occurred.

EXAMPLE 7

A multilayer container having a flange portion of 60 mm ϕ 40 mm (height) was formed from the multilayer sheet (I) of Example 1 by vaccuum and pressure thermo-forming.

In the flange portion of the multilayer container (8mm in width), the inner portion (3mm in width) was formed into a non-heat seal surface of a gradually inclined plane. A ring notch was formed at 2 mm distance from the outer end of the non-heat seal surface by pressing a ring having a V-shaped edge heated to 160 °C.

When the inner surface layer of the flange portion of the multilayer container having a notch obtained by the above-mentioned method was peeled, the inner surface layer was cut at the notch portion.

When the lid member (1) used in Example 1 was heat sealed to the multilayer container at the flange portion, the non-heat seal surface was not heat sealed. Further, when the lid member was peeled, delamination of the multilay r container occurred, then the inner surface layer of the multilayer container was cut at the notch, so that opening was easily conducted. The opening force was stable.

EXAMPLE 8

A flanged multilayer container of 60 mm ϕ x 40 mm (height) was formed from the multilayer sheet (I) used in Example 1 by vacuum and pressure thermo-forming. A heat unfusible layer of silicone resin as shown in FIG. 17a was provided to the inner portion of the flange portion of the multilayer container. The multilayer container was covered with the lid member (1) used in Example 1, then, by the use of a heat seal ring (t = 3mm, width of the extruding ring: 1mm), heat sealing and forming of a notch were conducted simultaneously, at a temperature of 170 to 190 °C, and pressure of 2kg f/cm^2, for one second, as shown in FIG. 14.

When the container thus formed was peeled the lid member, delamination of the multilayer sheet of the multilayer container occurred, then the inner surface layer of the multilayer container was cut at the notch so that the container was opened easily. Also, the opening force was stable.

EXAMPLE 9

A flanged multilayer container of 60 mm ϕ x 40 mm (height) having a rib portion of 6 mm in length was formed from the multilayer sheet (I) used in Example 1 by vaccuum and pressure thermo-forming. At the inner peripheral portion of the multilayer container, an inclined plane of θ = 20 ° in angle of inclination was provided, and a notch of 60μm in depth was formed at a position of t=2 mm. At the rib portion, two incisions of 7 mm in length each extending frm the lower end of the rib to the flange level were made with the space of 10mm, then, after the cut piece between the incisions were lifted to make a flat surface, the flat surface was cut away. To the multilayer container, a lid member having a tongue portion and the same layer structure of the lid member (1) used in Example 1 was so heat sealed that the tongue portion would located on the cut-off portion of the multilayer container.

When thus obtained easily-openable packaging container was opened by lifting the tongue piece of the lid member, delamination began from the cut-off portion under the tongue piece, then the inner surface layer was cut at the notch, and the container was opened easily.

Claims

1. The use of a multilayer sheet comprising at least a peelable surface layer and a layer contacting the peelable surface layer, the interlaminar, peeling strength between said two layers being adjusted to a value in the range of 0.2 to 1.5 kg/15 mm, for the production of an optionally notched multilayer container.

2. The use according to claim 1, wherein the interlaminar peeling strength is adjusted to a value in the range of 0.3 to 1.2 kg/15 mm.

3. The use according to claim 1 or 2, wherein the multilayer sheet consists of two layers.

4. The use according to claim 3, wherein the multilayer sheet is a combination of (A) a layer of a resin mixture of polypropylene base resin and a polyethylene base resin and (B) a layer of a high density polyethylene resin.

5. The use according to any of the claims 3 or 4, wherein the multilayer sheet comprises one or more additional layers.

6. A multilayer container for producing an easily openable packaging container by heat sealing a lid member thereto, which comprises at least a peelable surface layer and a layer contacting the peelable surface layer, the interlaminar peeling strength between said two layers being adjusted to a value in the range of 0.2 to 1.5 kg/15 mm so that the opening of said packaging container begins with the delamination between said two layers.

7. A multilayer container according to claim 6, wherein the interlaminar peeling strength between the said two layers is adjusted to a value in the range of 0.3 to 1.2 kg/15 mm.

8. A multilayer container according to claim 6 or 7, in which the multilayer structure comprises one or more additional layers.

9. A multilayer container according to any of the claims 6 to 8, wherein the multilayer sheet is a combination of (A) a layer of a resin mixture of polypropylen base resin and a polyethylene base resin and (B) a layer of a high density poiyethylene resin.

Fig. 1

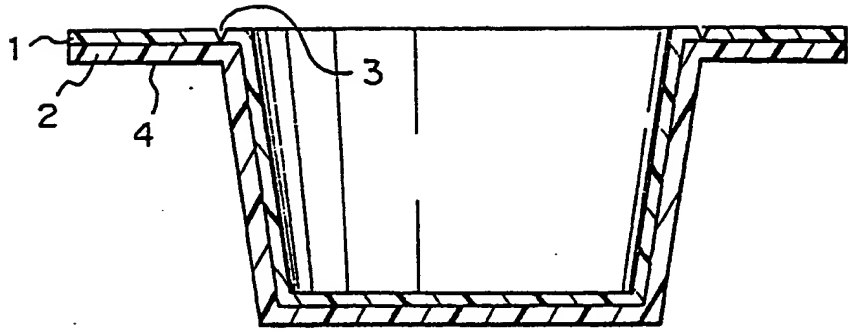


Fig. 2

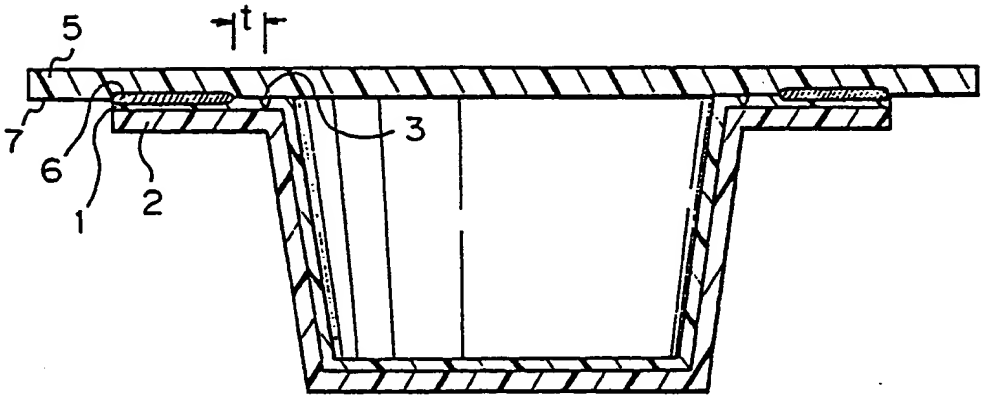


Fig. 3

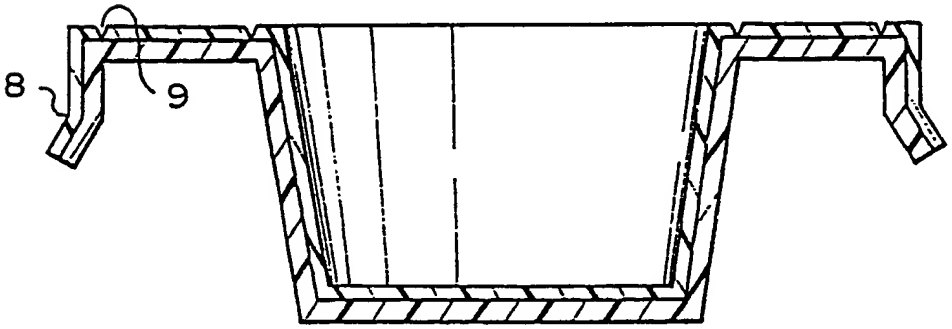


Fig. 4 a

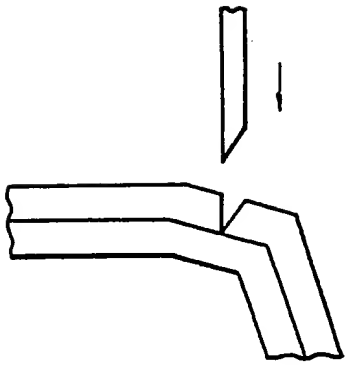
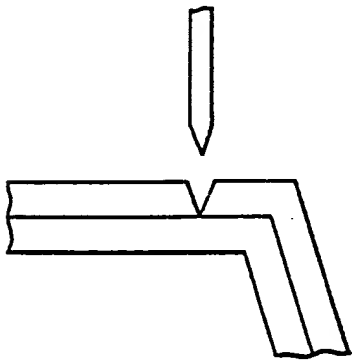


Fig. 4 b

Fig. 4 c



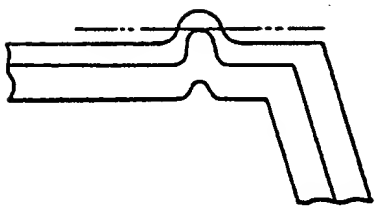
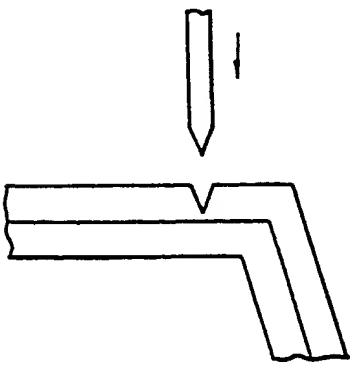


Fig. 4 d

Fig. 4 e



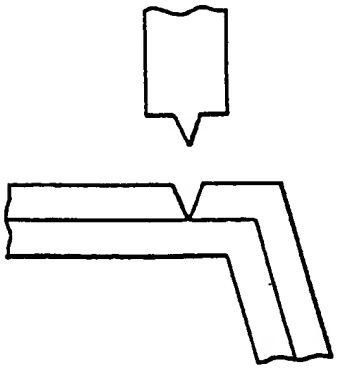
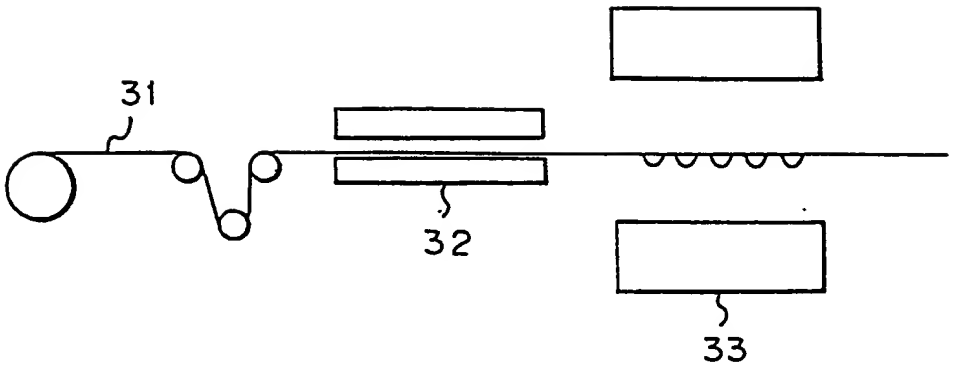


Fig. 5



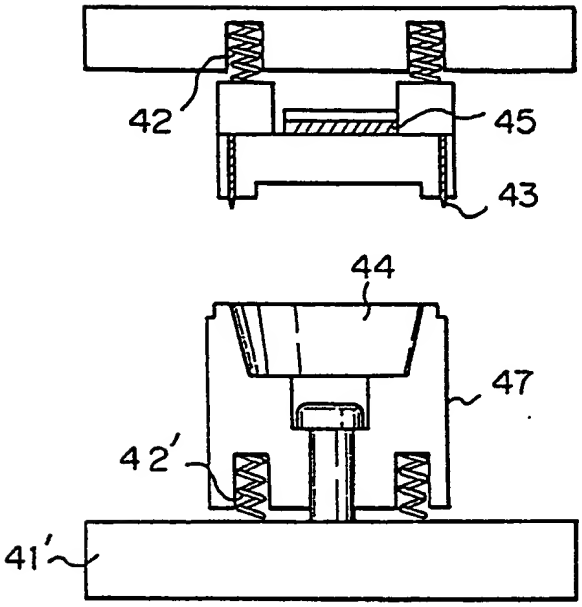


Fig. 6

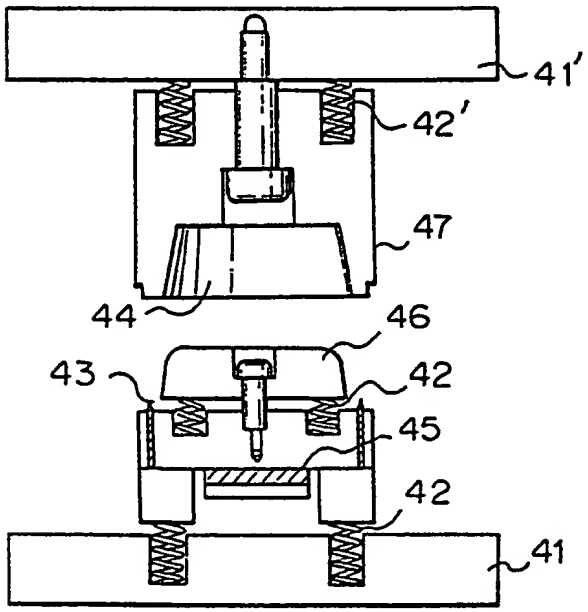


Fig. 7

Fig. 8

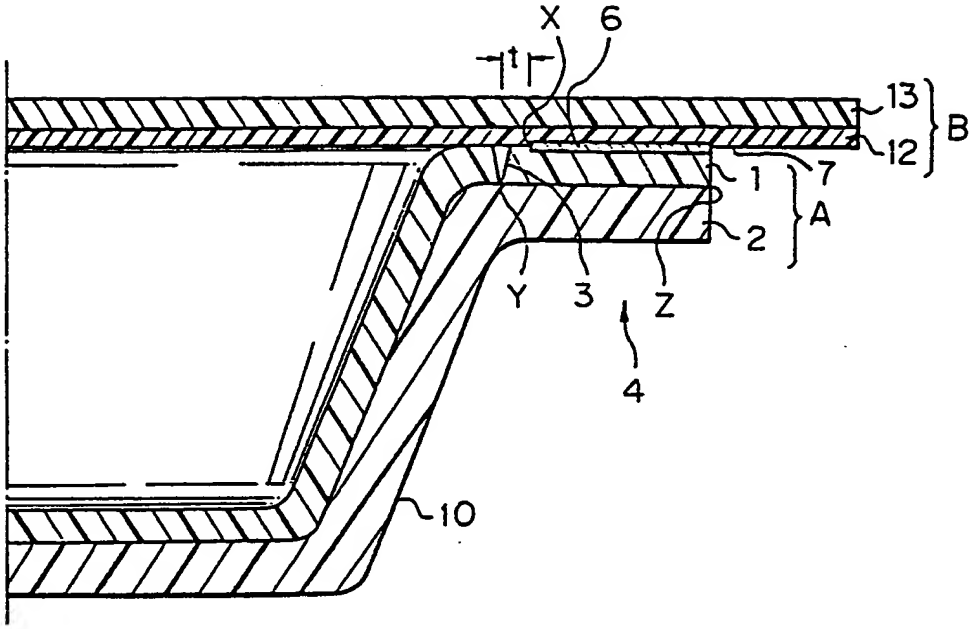


Fig. 9

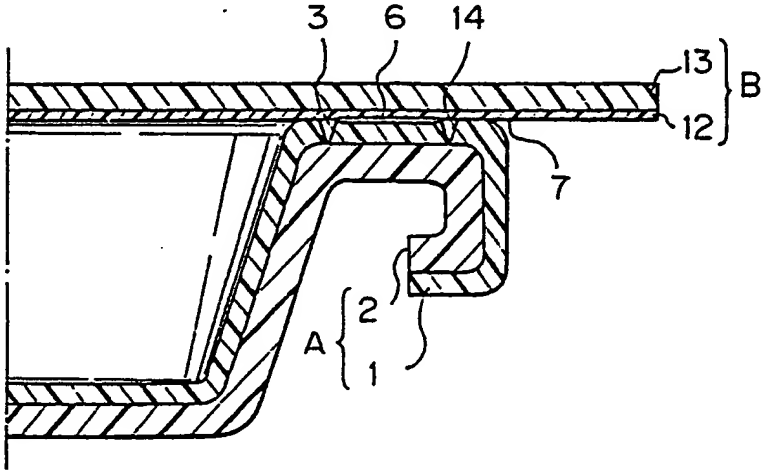


Fig. 10

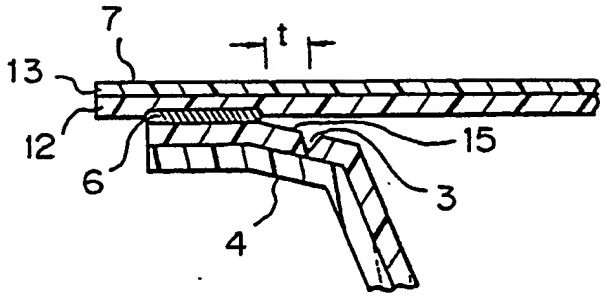


Fig. 11

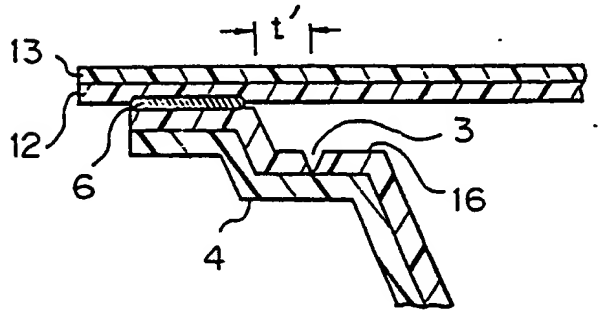


Fig. 12

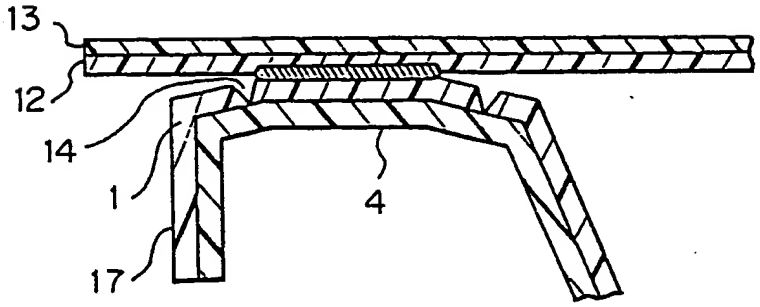


Fig. 13a

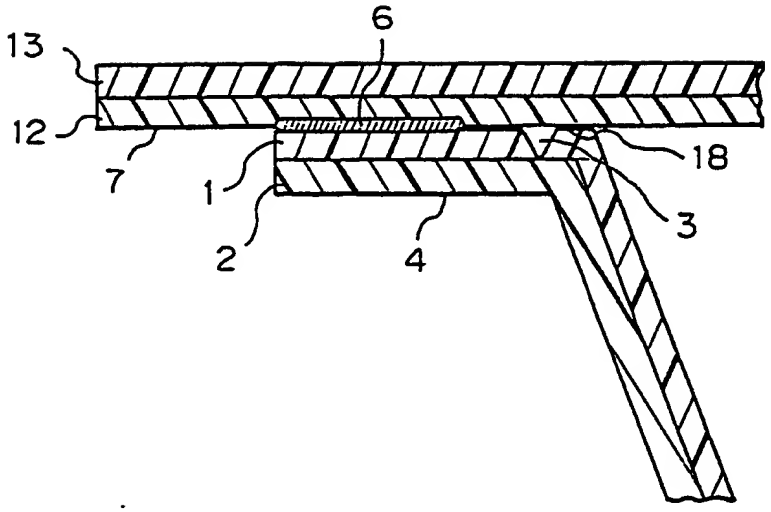


Fig. 13b

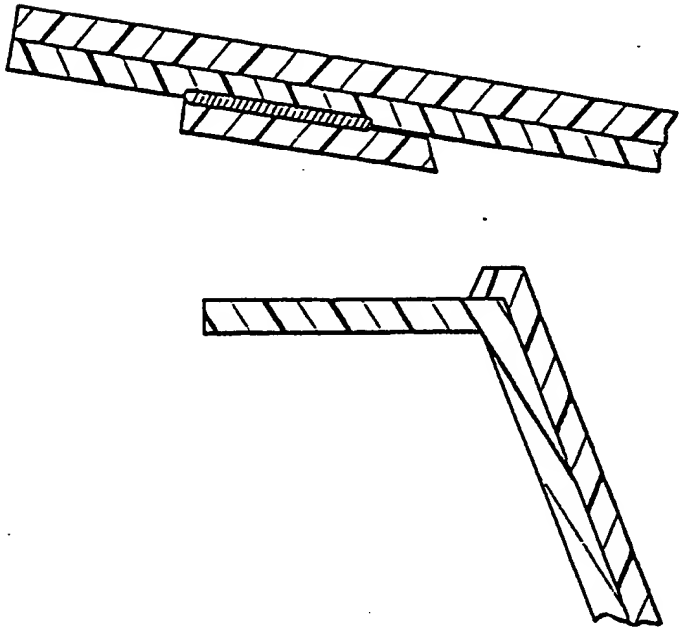


Fig. 14a

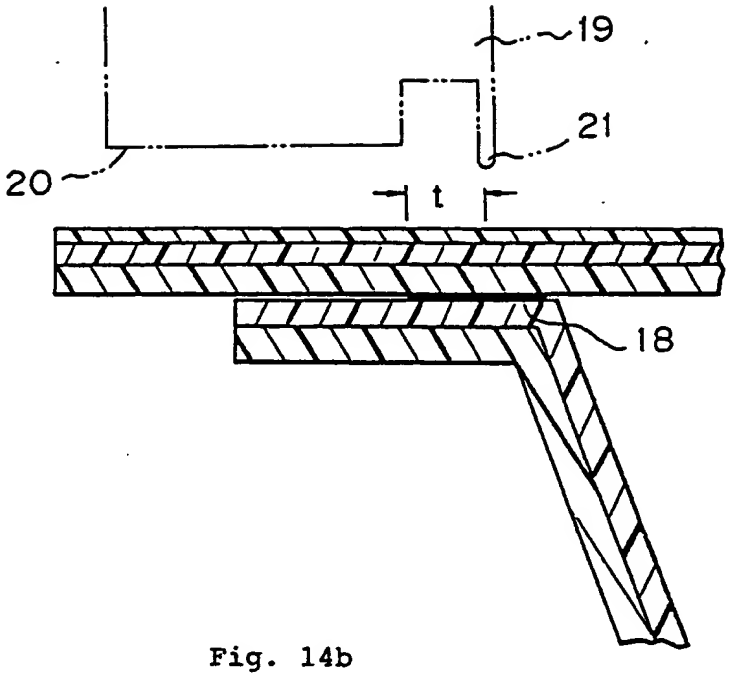


Fig. 14b

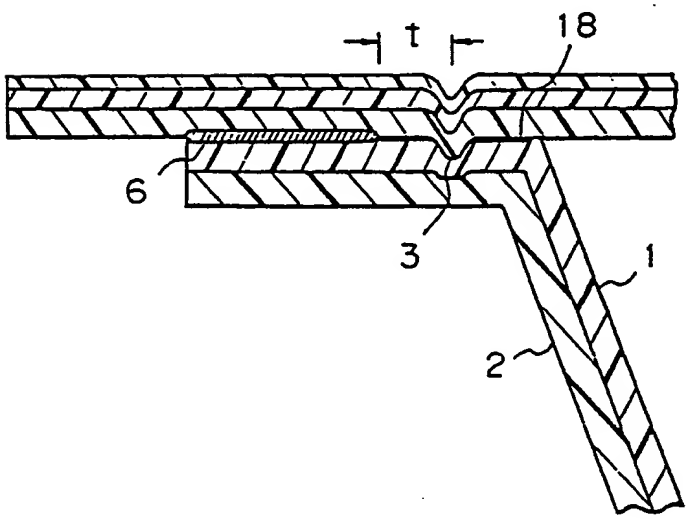


Fig. 15

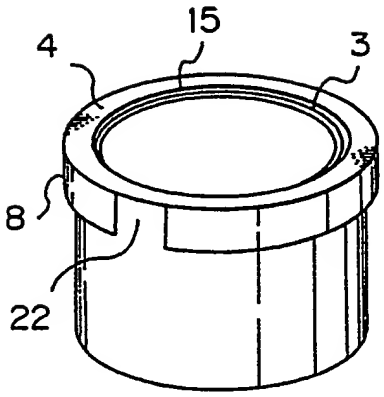


Fig. 16

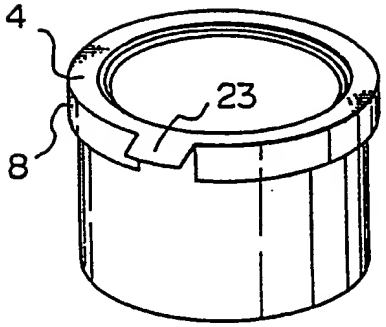


Fig. 17

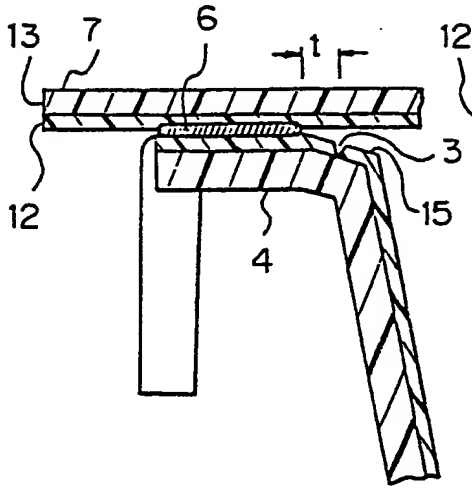


Fig. 18

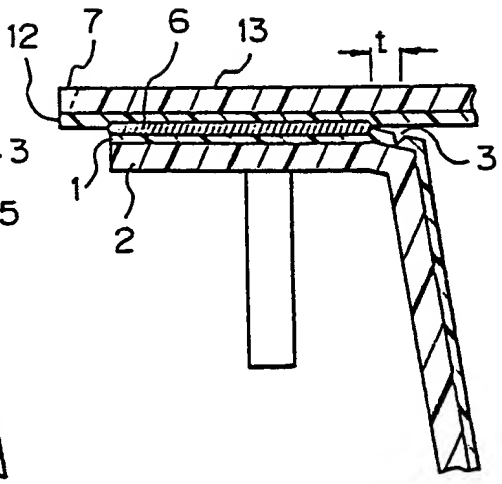


Fig. 19

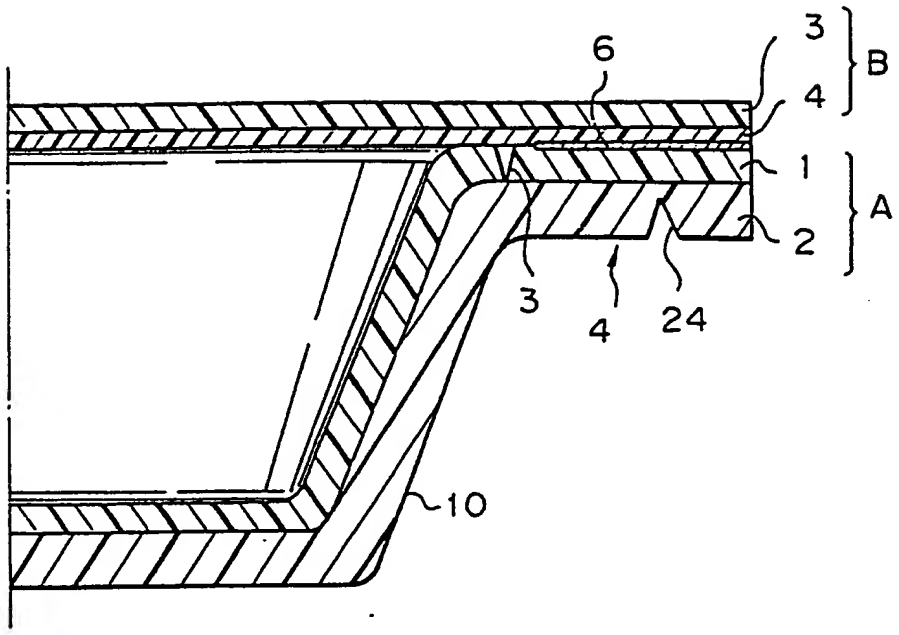


Fig. 20

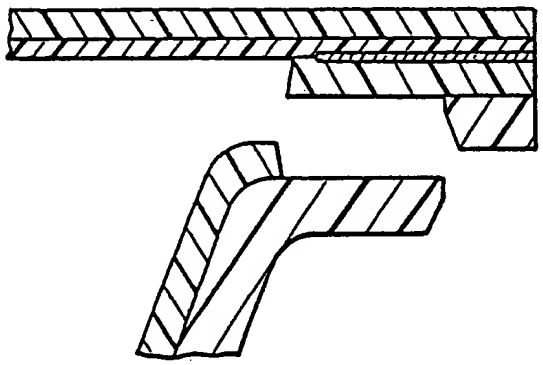


Fig. 21

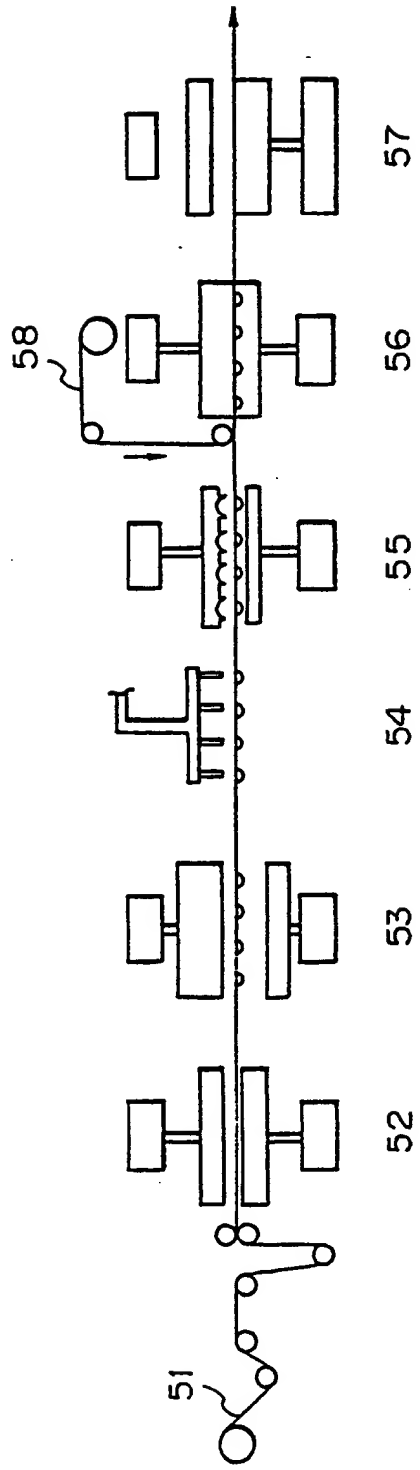


Fig. 22

Fig. 23

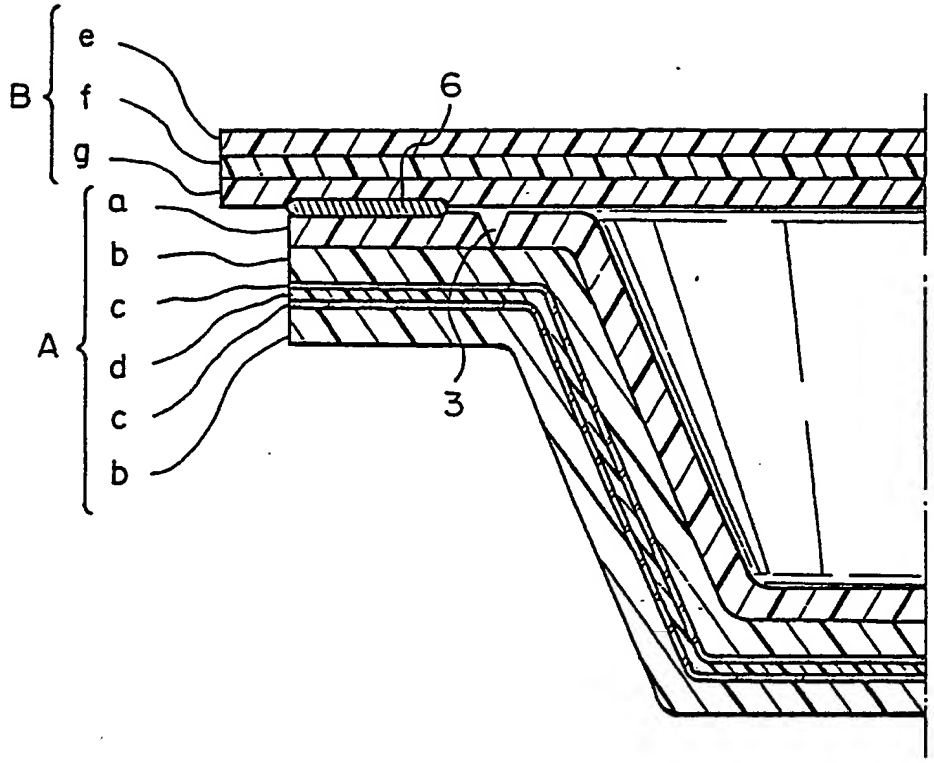
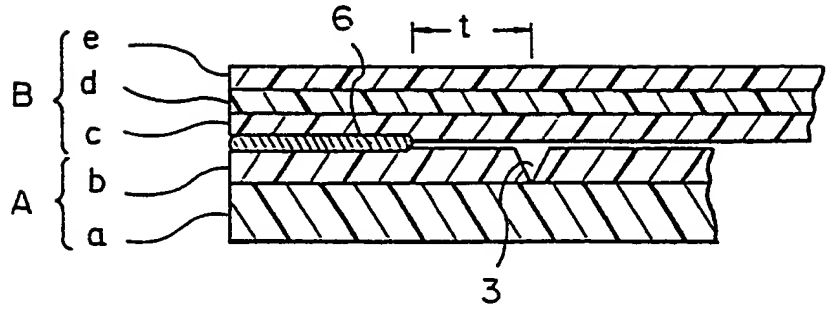


Fig. 24



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 10 2651

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US-A-4 521 467 (BERGER) * claims 1,2,6,9,14,15 *	1-9	B 32 B 7/06 B 32 B 27/08 B 65 D 77/20
X	DE-A-2 001 032 (CROWN ZELLERBACH CORP.) * claims 1,3-8,10-13 *	1,3-6,8,9	
A	DE-A-2 851 642 (JAPAN CROWN CORK CO.) * claim 1 *	1	
A	EP-A-0 015 472 (HOECHST) * claims 1,2,7 *	1,4-6,8,9	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 32 B 7/00
B 32 B 27/00
B 65 B 51/00
B 65 D 17/00
B 65 D 65/00
B 65 D 77/00
B 65 D 85/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	16-05-1988	GRUNFELD D.P.

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